Kentucky Green River Conservation Reserve Enhancement Program

Annual Program Accomplishment Report (CEP-68R)

FFY 2005

January 5, 2006

I. Executive Summary

The Green River is the most biologically diverse and rich branch of the Ohio River system. The greatest aquatic diversity occurs in a 100-mile section of unhindered river that flows from the Green River Reservoir Dam through Mammoth Cave National Park (the world's longest and most diverse cave system) in south central Kentucky. This section of the Green River Watershed includes 917,197 acres in the counties of Adair, Barren, Edmonson, Green, Hart, Metcalfe, Russell, and Taylor. Data indicates that agricultural runoff contributes high levels of sediment, nutrients, pesticides, and pathogens to the Green River and Mammoth Cave Systems. There are currently seven species listed as endangered by the U.S. Fish and Wildlife Service in the Green River System. In addition, the project area also includes several ecosystems recognized as Endangered Ecosystems of the United States, including native prairies, hardwood savannahs, canebrakes, and old-growth deciduous forest.

On August 29, 2001, the U.S. Department of Agriculture (USDA) and the Commonwealth of Kentucky agreed to implement a Conservation Reserve Enhancement Program (CREP) on the section of the Green River referenced above to restore up to 100,000 acres. The Kentucky Chapter of the Nature Conservancy is a primary contributor, offering permanent easements to landowners in addition to CREP contracts, and offering public relations and BMP implementation assistance. The Kentucky Department of Fish and Wildlife Resources (KDFWR) is a contributor, offering wildlife biologists and cost-shared positions with NRCS to assist landowners and promote the program to enhance participation in CREP. The Kentucky Division of Conservation was designated as the state administrative contact agency for Green River CREP, and distributes state cost share and incentive payments to landowners.

A spring located on the Green River within the CREP Region. Photo courtesy of Joe Meiman, Mammoth Cave National Park

FFY 2005 has shown steady enrollment into the program. In the previous years since program initiation, the overall acreage enrolled has been slightly higher each year, as individual counties "spiked" with regards to interest and enrollment during different fiscal years. At this point, we are observing a steady interest and enrollment. Processes with regards to working the program have become more streamlined and homogenous, and many in the general public are seeing the benefits of this program from those that previously enrolled. Because the initial "spikes" occurred in the primary counties, and because, to some degree, of speculation on the proposed changes to this program that will make it a more effective and practical program for this area, the enrollment has seen a leveling effect. Despite the slightly lower acreage enrolled this fiscal year, this program is a more common topic of discussion and is known more within the region now than ever before. The proposal for programmatic changes is currently in the submission phase, and if these changes are incorporated into the Green River CREP, it is widely speculated that landowner participation will greatly exceed levels observed within the region to this point.

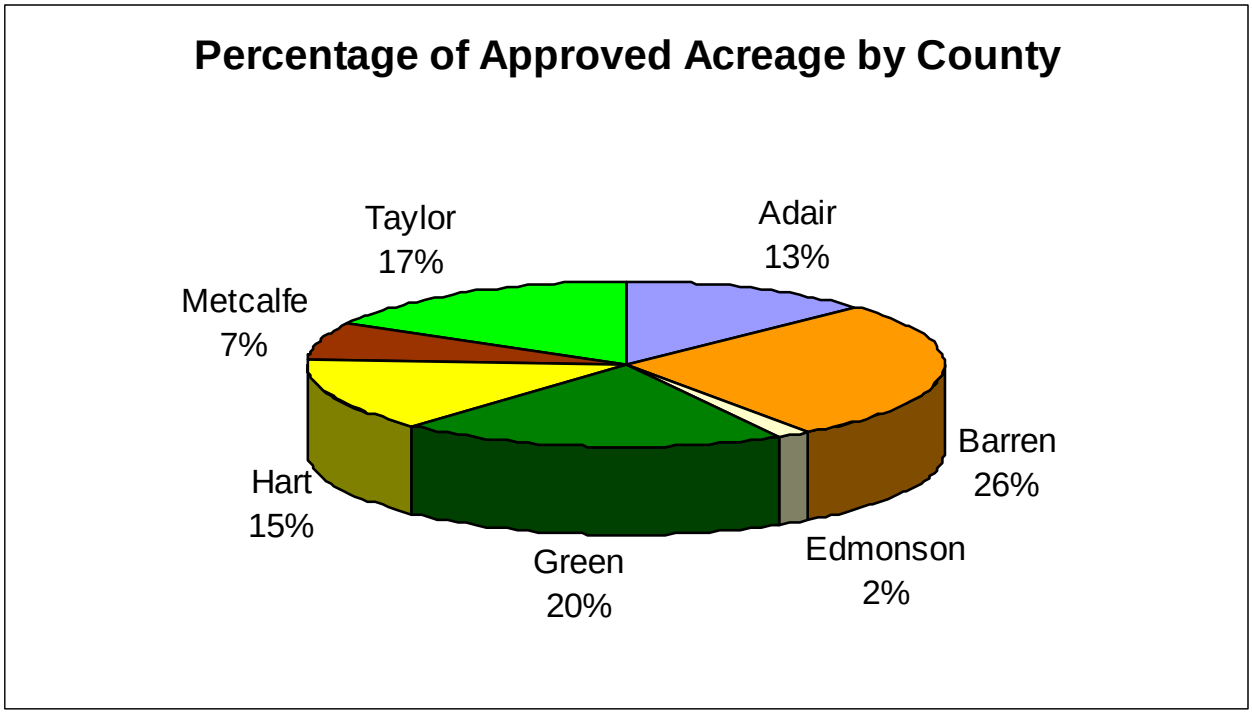
During FFY 2005, the Green River CREP had 109 contracts approved, totaling 1,397.7 acres. Adair, Barren, Green, and Taylor Counties are the most consistent with regards to enrollment acreage. Those counties have compiled 76% of the total acreage enrolled since this program began. Hart and Metcalfe Counties also had consistent enrollment during this fiscal year, only slightly below the levels of the initial four mentioned above. Of the contracts enrolled to this point, the Riparian Buffer (CP22) and Native Warm Season Grass Plantings (CP2) are dominant practices. These two practices account for 97% of the enrolled acreage. An in-depth statistical breakdown of the program is provided on the following pages.

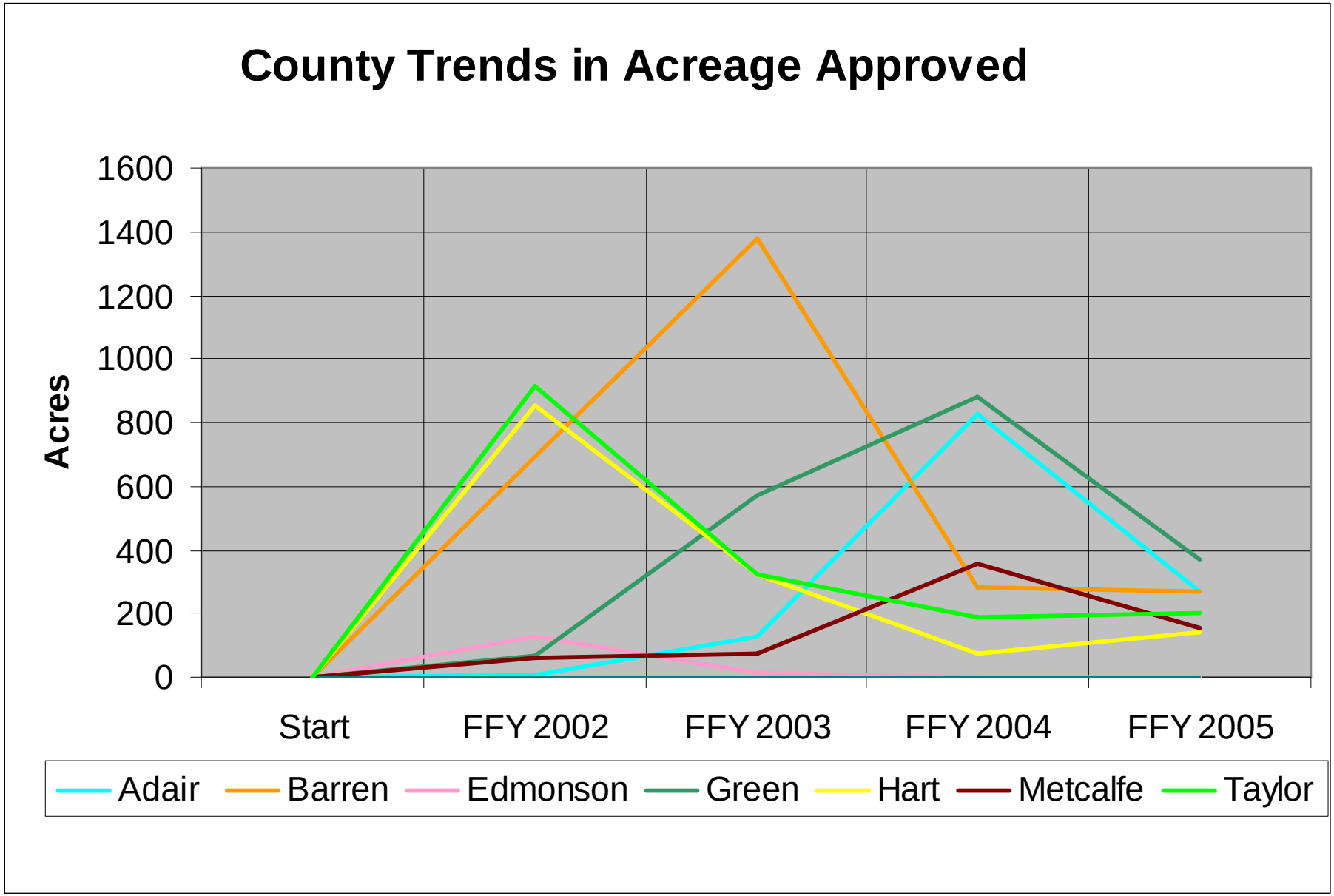
Riparian Buffer on Russell Creek in Adair County. Photo taken during a producer field day.

Total Acreage per County per FFY

County	Total Acreage by FFY				Cumulative Total
	FFY 2002	FFY 2003	FFY 2004	FFY 2005	
Adair *	4	124.6	827.6	270.1	1,226.30
Barren	695.3	1,375.10	282.9	267.3	2,620.60
Edmonson	129.8	16	0	0	145.8
Green	66.1	571.5	881.7	367.1	1,886.40
Hart	850.9	323.9	75.2	139.4	1,389.40
Metcalfe	59.9	75.5	359.6	153.6	648.6
Russell	0	0	0	0	0
Taylor	915.6	319.5	189.7	200.2	1,625
Total	2,721.60	2,806.10	2,616.70	1,397.70	9,542.10

* In last year's report, acreage for Adair County for FFY 2004 was incorrectly reported. Total use exclusion acres were reported, including those acres with already existing trees, which are not paid acres. This chart properly reflects the total contracted acreage by FFY.




County Trends in Acreage Approved
Acres
1600
1400
1200
1000
800
600
400
200
0
Start
FFY 2002
FFY 2003
FFY 2004
FFY 2005
Adair
Barren
Edmonson
Green
Hart
Metcalfe
Taylor

Cumulative Program Acreage/Contracts by County

County	Approved Contracts		
	Practice	Number	Acres
Adair	CP1 Introduced Grasses	1	4
	CP2 Native Grasses	7	186.6
	CP3A Hardwood Tree Planting	2	5.8
	CP22 Riparian Buffer	105	1029.9
Barren	CP1 Introduced Grasses	1	2.7
	CP2 Native Grasses	61	2326.4
	CP3 Tree Planting	1	15.5
	CP22 Riparian Buffer	25	276
Edmonson	CP1 Introduced Grasses	1	22.7
	CP2 Native Grasses	2	122.1
	CP21 Filter Strip	1	1
Green	CP2 Native Grasses	8	157
	CP22 Riparian Buffer	82	1729.4
Hart	CP1 Introduced Grasses	6	150.1
	CP2 Native Grasses	4	56.5
	CP22 Riparian Buffer	47	1182.8
Metcalfe	CP2 Native Grasses	15	453.1
	CP22 Riparian Buffer	20	195.5
Russell	None	0	0
Taylor	CP2 Native Grasses	23	498.2
	CP3A Hardwood Tree Planting	2	45.8
	CP22 Riparian Buffer	89	1081

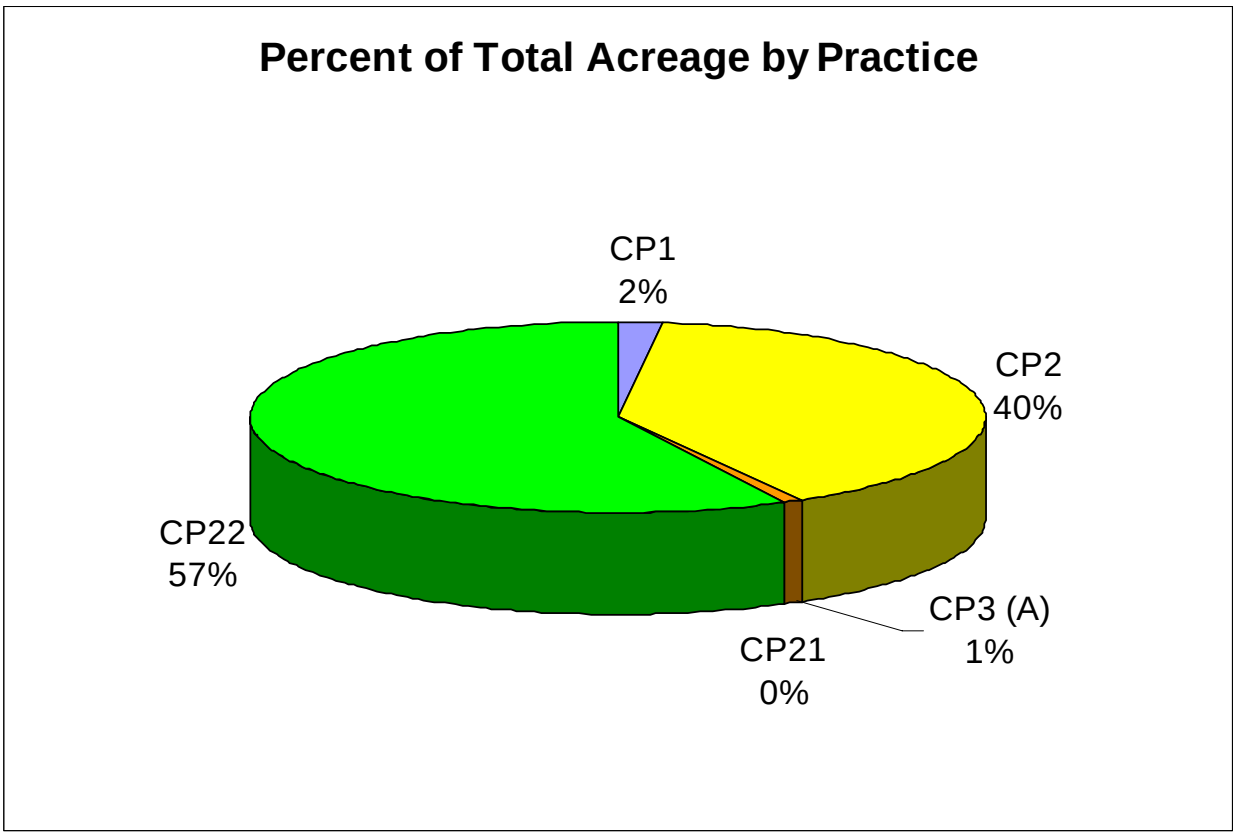
Totals	All	503	9542.1

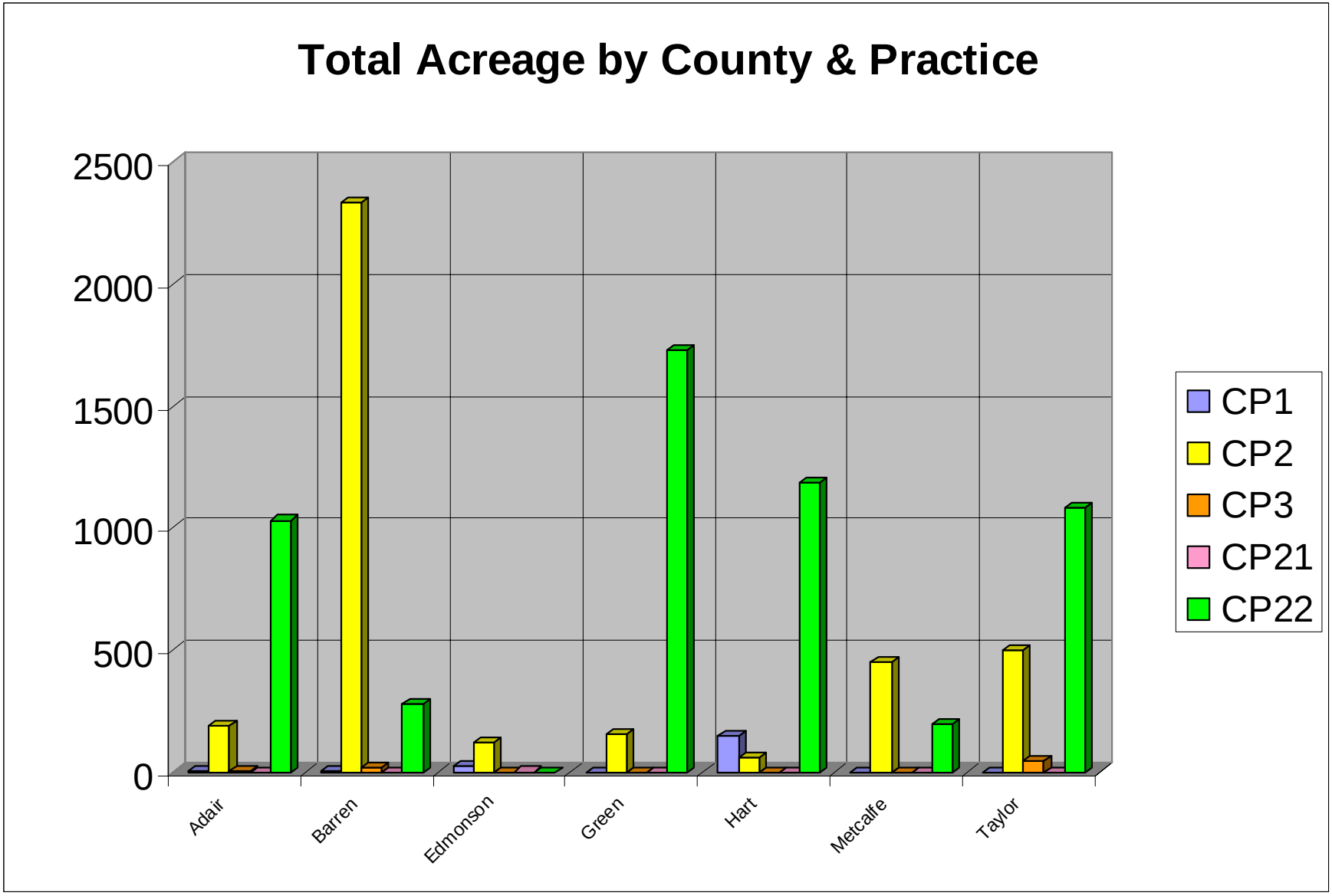
CREP Display at annual Green River Fest in Munfordville, KY

Cumulative Total Contracts and Acreage by Practice

Practice Code	Approved Contracts		
	Practice	Number	Acres
CP1	Introduced Grasses/Legumes	9	179.5
CP2	Native Warm Season Grasses	120	3799.9
CP3 (A)	Tree Planting	5	67.1
CP21	Filter Strip	1	1
CP22	Riparian Buffer	368	5494.6

Totals	All	503	9542.1




Total Acreage by County & Practice
2500
2000
1500
1000
500
0
Adair
Barren
Edmonson
Green
Hart
Metcalfe
Taylor
CP1
CP2
CP3
CP21
CP22

Program Cumulative Payment Summary

County	Average Acres/Contract	Avg. Rental Rate/Acre	Incentive Paid Per Acre	Total Estimated Cost-Share
Adair	10	$97	$45	$342,172
Barren	30	$111	$46	$426,724
Edmonson	49	$103	$41	$14,544
Green	20	$129	$61	$393,254
Hart	25	$138	$64	$189,559
Metcalfe	21	$103	$44	$91,880
Russell	NA	NA	NA	NA
Taylor	15	$119	$54	$260,488
Region	19	$118	$53	$1,765,863

FY 2005 Payment Summary

County	Average Acres/Contract	Avg. Rental Rate/Acre	Incentive Paid Per Acre	Total Estimated Cost-Share
Adair	10	$100	$46	$244,992
Barren	16	$118	$50	$22,379
Edmonson	NA	NA	NA	NA
Green	18	$125	$67	$161,940
Hart	23	$137	$65	$23,435
Metcalfe	20	$104	$46	$39,103
Russell	NA	NA	NA	NA
Taylor	6	$124	$58	$24,350
Region	13	$114	$52	$548,699

Stream Miles Buffered by Green River CREP

County	Miles of Stream Buffered
Adair	38.6
Barren	8
Edmonson	0
Green	33.8
Hart	23.4
Metcalfe	7.4
Russell	0
Taylor	23.3

Total	134.5

II. State and Local Partners' Financial Contribution

The Kentucky Chapter of The Nature Conservancy
(TNC)

Richie Kessler, the Green River Director, TNC, submitted the following written summary and financial contribution chart of TNC's activity during FFY 2005:

The Nature Conservancy was very active in the promotion and implementation of the CREP program in 2005. TNC made a minimum of 50 landowner visits/contacts and assisted numerous field offices in site visits or field work on numerous occasions. TNC participated in several events promoting the program and co-hosted a CREP Field Day and Celebration on the farm of Mr. Dan Richardson in Hart County. The event featured speakers from various partners including the USDA, Commonwealth of Kentucky, TNC, Western Kentucky University, and Senator Mitch McConnell. During the year of 2005 the CREP permanent easement (valued at $480 in 2005) was recorded on 14 tracts totaling just over 380 acres for the year. The cumulative total is 20 easements totaling ~ 460 acres. TNC ceased recording easements in October 2005 in order to reevaluate the value of the easement. The value increased substantially to $650 per acre. TNC will resume implementation of the CREP permanent easement with a series of workshops beginning in January 2006. We expect high levels of activity in the easement program in calendar year 2006.

Kentucky CREP - TNC Match Commitment
TNC Center 1170133800

Financial Update **October 1, 2004 - September 30, 2005**

Budget Categories	Budget 7/1/04-6/30/06	Grand Total **Federal FY05**
Salaries/Benefits	50,000	18,973.61
Travel	4,000	3,204.44
Supplies	6,450	73.10
Equipment	0	0.00
Contracts	40,000	16,000.00
Other	50	1,476.39
Subtotal	**100,500**	**39,727.54**
Indirect Costs @ 25%	**25,125**	**8,332.81**
Indirect Costs @ 22%		**1,407.19**
Total	**125,625**	**49,467.54**
In-kind donations	0	0.00
Land acq. (ease'ts)*	374,375	190,704.00
Land acq. - Other	0	10,474.00
Grand Total	**500,000**	**250,645.54**

*Easements:	Center:	Amount:	Other:	
Gorin	2170139038-0018	3,504.00	790.00	EA, title exam, fees
Wilson	2170139038-0022	6,768.00	458.00	EA, title exam, fees
Caerphilly	2170139038-0023	20,304.00	546.00	EA, title exam, fees
Van Fossen	2170139038-0024	25,104.00	790.00	EA, title exam, fees
R. Simpson	2170139038-0025	19,296.00	696.00	EA, title exam, fees
G. Simpson	2170139038-0026	16,128.00	451.00	EA, title exam, fees
Paxton	2170139038-0027	4,080.00	790.00	EA, title exam, fees
Payne	2170139038-0028	10,896.00	419.00	title exam, rec fees
May-Sargent	2170139038-0030	4,560.00	790.00	EA, title exam, fees
Willis	2170139038-0032	3,408.00	790.00	EA, title exam, fees
Baker	2170139038-0033	2,736.00	790.00	EA, title exam, fees
Handy	2170139038-0035	24,480.00	790.00	EA, title exam, fees
Greschel	2170139038-0037	33,024.00	790.00	EA, title exam, fees
Montgomery	2170139038-0038	7,872.00	790.00	EA, title exam, fees
Stearman	2170139038-0040	8,544.00	794.00	EA, title exam, fees

Kentucky Department of Fish and Wildlife Resources
(KDFWR)

The Kentucky Department of Fish and Wildlife Resources has been a key partner in field implementation of the Green River CREP. KDFWR has contributed man-hours from several field positions, including KDFWR/NRCS Liaisons, private lands biologists, and three CREP Biologists. KDFWR personnel adopted many duties working both directly with landowners and with NRCS District Conservationists. These biologists also helped with the physical establishment procedures, such as on site guidance and delivery of seed drills, spray equipment, etc. These biologists also initiated landowner contacts, and coordinated and/or assisted with field days and informational meetings. A rough estimate of more than 265 man- hours were worked on CREP by the Private Lands Biologist and NRCS Liaison positions alone. The three CREP Biologists, which CREP is their primary job function, worked more than 2,836 man-hours.

The above referenced CREP Biologists, which are supervised by KDFWR in partnership with NRCS (and some funding from USFWS), has greatly aided in the following tasks for this program: assisting with program promotion, planning, contract writing and modifications, on-site measurements and practice layout; site visits during practice installation; practice evaluation, final and annual status reviews; providing technical guidance on vegetation plantings which includes site preparation, planting, and post-planting management to ensure successful stand establishment; and assisting District Conservationists with writing and/or modifying participants' contracts.

Additional costs to KDFWR not covered by the above referenced activities are as follows: cost shared portion of funding for CREP Coordinator position - $17,500; cost share provided to landowners for implementation/management of CREP practices - $41,263.

KDFWR Biologist Steve Beam speaks to local landowners about native grasses at a CREP Field Day in Adair County

Kentucky Division of Forestry (KDOF)

The Kentucky Division of Forestry has been primary in providing technical assistance and guidance with tree planting practices within the Green River CREP. In addition to the tree planting specific practices (CP-3A), all riparian buffers (CP-22) are required to have a minimum of 50’ of trees planted adjacent to the water body. In addition to technical guidance and assistance, KDOF personnel have also assisted landowners with tree seedling orders, most of which are through our State nursery.

Kentucky Division of Conservation
(KDOC)

The Kentucky Division of Conservation is the state contact agency for the Green River CREP. The Division administers the financial portion of CREP (state cost share and incentive payments), and works closely with local conservation districts and partner agencies in the promotion and administration of the program. In addition, the Green River CREP Coordinator works through, and is partially funded by, the KDOC. The Division has also administered funding for the hiring of the three Green River CREP Technicians located within the region. The following is payment information on state contributions to CREP contracts:

County	TOTAL Contracts	TOTAL Dollars
Adair	54	$96,366.00
Barren	76	$334,525.00
Edmonson	3	$10,688.00
Green	82	$202,122.75
Hart	60	$158,888.50
Metcalfe	34	$71,307.00
Russell	0	$0.00
Taylor	102	$238,553.00
Totals:	411	$1,112,450.25

Kentucky CREP MATRIX

				Federal						State [5/]
Code	**Practice**	**Land Eligibility Criteria**	**Land Use Criteria [6/]**	**Base CS** %	**PIP** %	**SIP** ($10/AC/YR) (1 TIME)	**SRR Incentive** (ac/yr) (% x SRR)	**Maintenance No Water Development**	**Maintenance Fence/ Water Development**	**STATE CS** %
CP-1	Introduced Grasses and Legumes	HEL [1/]	CH	50			50	$5/ac/yr		25
CP-2	Native Grasses	HEL [1/]	CH	50			75	$5/ac/yr		25
CP-3	Tree Planting	HEL	CH	50			100	$5/ac/yr		25
CP-3A	Hardwood Tree Planting	HEL [1/ 2/]	CH	50			100	$5/ac/yr		25
CP-4B	Permanent Wildlife Habitat (Corridors)	HEL	CH	50			75	$5/ac/yr		
CP-4D	Permanent Wildlife Habitat	HEL	CH	50			75	$5/ac/yr		
CP-8A	Grassed Waterways, Non-easement	NA	CH	50	40	X	75	$5/ac/yr		25
CP-9	Shallow Water Areas for Wildlife	NA	CH	50	40		75	$5/ac/yr		
CP-10	Veg.Cover--Grass--Already Established	HEL [3/]	CH	0			NA	$5/ac/yr		
CP-11	Veg. Cover--Trees--Already Established	HEL [3/]	CH	0			NA	$5/ac/yr		
CP-12	Wildlife Food Plots	HEL	CH	0			NA	NA		
CP-15A	Contour Grass Strips	NA	CH	50	40		50	$5/ac/yr		25
CP-21	Filter Strips	NA	CH	50	40	X	75	$5/ac/yr	$9/ac/yr	25
CP-22	Riparian Buffers	NA	CH/MP	50	40	X	100	$5/ac/yr	$9/ac/yr	25
CP-23	Wetland Restoration	NHE	CH	50 [4/]			100	$5/ac/yr		
CP-25	Rare and Declining Habitat	HEL	CH	50			100	$5/ac/yr		

[1/] NHE land is eligible on acreage buffering a non-cropped wetland

[2/] NHE land is eligible on scour erosion areas & must be planted in hardwoods only.

[3/] Previous CRP contract acreage

[4/] An additional one-time 25% Cost-Share Incentive is optional

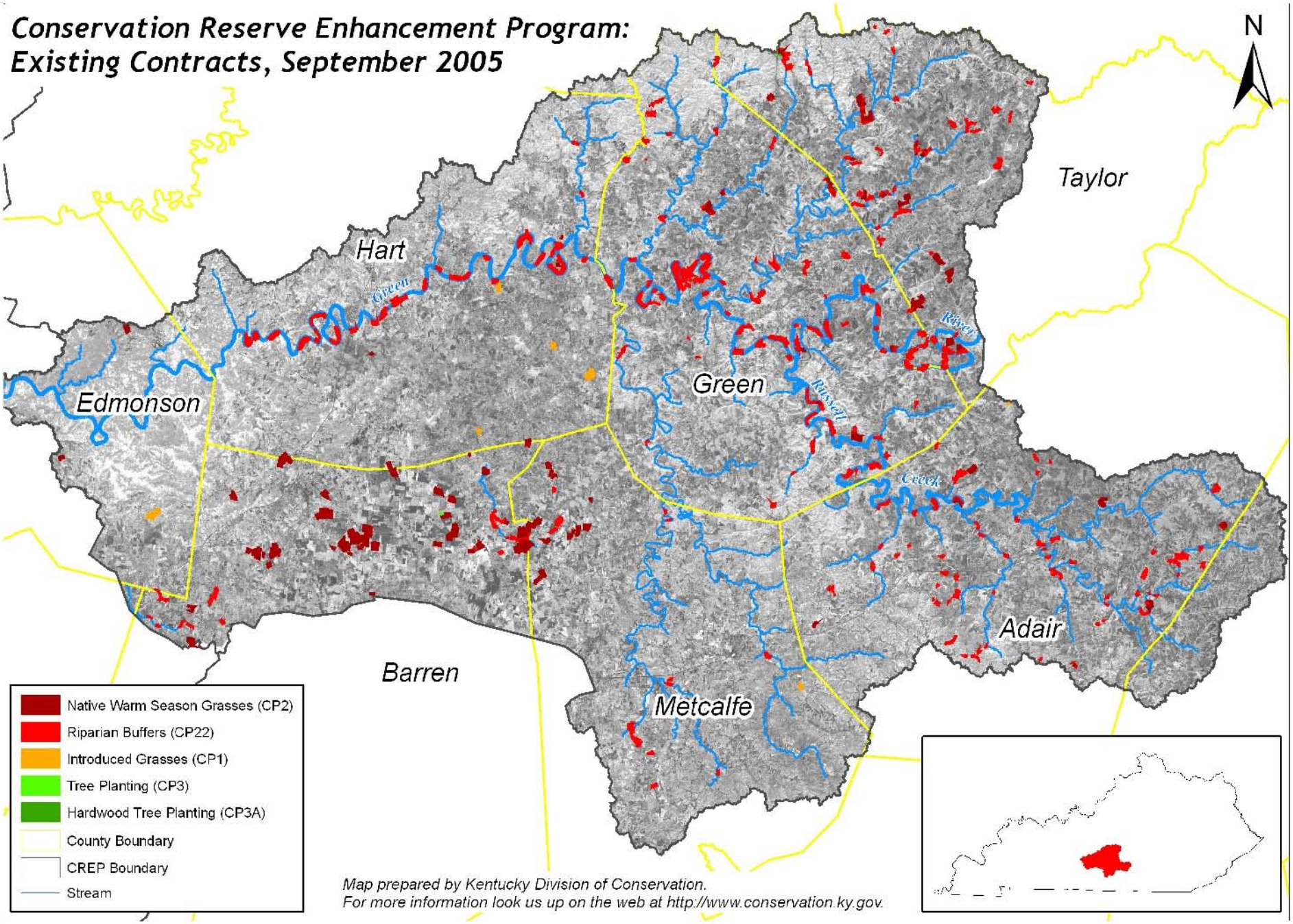
[5/] Additional Incentives may apply, see state incentives below.

[6/] CH: Crop History; MP: Marginal Pastureland

Non-Federal Commitments	
Easements:	**State Incentives (Based on cost of installing practice)**
Permanent - $400/acre lump sum or installments	**75% when land will be entered into a permanent easement**
35 year supplemental contracts - $300/acre lump sum or installments	55% for land entering a 35 year supplemental contract for lands enrolled as riparian buffers or wetland restoration
15 year supplemental contracts - $150/acre lump sum or installments	50% for land entering a 15 year supplemental contract regardless of the practice.
No supplemental contract or easement	25% Incentive for non-easement contracts

Cost Share:
75% cost-share for practices not eligible for federal CRP (limited point access to streams for livestock; water lines and tanks)(funded KCREP3)
KCREP3 - Requirements: Not eligible if landowner is eligible for CREP cost share. Eligible land is restricted to areas within the approved CREP boundary, but does not meet FSA program eligibility criteria for CREP. Eligible lands must be in pasture and adjacent to streams being accessed by livestock. Fence must be installed at the edge of existing tree lines or at the top of the bank at a minimum. If buffer areas already exist, they do not have to be enhanced to meet federal CREP guidelines or NRCS practice standards to be eligible for CREP. **NOTE**: Federal cost-share can not exceed 100% from all sources. State cost-share cannot exceed 75% from all sources.

Conservation Reserve Enhancement Program: Existing Contracts, September 2005



Map prepared by Kentucky Division of Conservation.
For more information look us up on the web at http://www.conservation.ky.gov.

III. Monitoring and Evaluation

The following monitoring summary was submitted by Dr. Scott Grubbs, Western Kentucky University:

ANNUAL REPORT

Assessing changes across spatial and temporal scales due to conservation practices associated with the Kentucky Conservation Reserve Enhancement Program in the Upper Green River Basin

Annual report submission to:

National Resources Conservation Service

771 Corporate Drive, Suite 210

Lexington, KY 40503-5479

Project director:

Scott Grubbs, Ph.D.

Department of Biology and Center for Biodiversity Studies

Western Kentucky University

Bowling Green, KY 42101

Date:

December 10, 2005

Background

In 2001 the Upper Green River Basin was established as the geographic entity of Kentucky's U.S.D.A. Conservation Reserve Enhancement Program (CREP). The main goal of the nearly 40,000 ha Kentucky CREP is to reduce nonpoint source pollution loading (e.g., sediment, industrial fertilizer) into the mainstem of the Upper Green River and principle tributaries by recruiting landowners into incentive-based 10-15 yr. cooperative agreements of best management practices aimed to eliminate riparian-based agricultural and animal husbandry practices. Specific measurables that are incorporated in CREP goals are multifaceted and include (a) 10% reduction of sediment, nutrients, and pesticides entering the river and its tributaries from agricultural sources, (b) enhancement of aquatic and riparian habitat, (c) enhancement of aquatic wildlife populations habitat, (d) restoration of riparian habitat corridors, (e) reconnection of landscape-level ecological processes, (f) establishment of riparian buffers around sinkholes, (g) restoration of non-riparian wetlands, and (h) protection and restoration of subterranean ecosystems.

Outline of individual tasks

Task 1: NRCS/CREP GIS mapping and analysis activities

Task 2: Hydrology, sediment and water quality activities

Task 3: Direct terrestrial monitoring activities

Task 4: Project enhancements and pilot studies

Task 5: Seminars and workshops

Task 1 Progress Report: NRCS/CREPGIS mapping and analysis activities

Task 1 Manager: Ouida W. Meier, Ph.D., Applied Research and Technology Program, Western Kentucky University

Two activities

- **Activity 1: GIS mapping and analysis of land use in the Upper Green River Basin**

  My lab has made very good progress in our task of GIS Mapping and Analysis. Land cover data sets and aerial imagery sets (National Agricultural Imagery Program 2003 and 2004) have been obtained as they have become available. GeoTIFFs for Kentucky counties using NAIP04 1-meter imagery are still not available, though the county compressed mosaics for CREP counties have been obtained and are in active use. This was a much less expensive solution than the commissioning of LANDSAT or IKONOS imagery for the region, and as with any dataset, has inherent limitations, but has proven to be a very workable solution. Forested riparian corridors within a 1000' buffer have been hand-selected along the mainstem of the Green River from the Green River Lake dam to the confluence with the Nolin River. Automated selection of riparian forest using specialized software was also attempted on a trial basis, but was not accurate enough for our analysis needs, so we are proceeding with hand selection. We are working on land use analysis within the buffer areas as well, and evaluating both riparian corridor and landuse within an upstream-downstream gradient as potential correlates of water quality measurements. Following a river survey by another task within the grant, we have mapped erosion points, distribution of cane breaks, and stretches of very thin riparian corridor along the mainstem of the Green River. The results of some of these observations and a preliminary analysis are listed in the Presentations section, and a number of maps are provided in the Maps section. Higher resolution imagery of any of these maps is available upon request (ouida.meier@wku.edu).

  Dr. Meier served as a reviewer of the NLCD (National Land Cover Dataset) and KLCD01 (Kentucky Land Cover Dataset 2001) data sets for the Commonwealth Office of Technology, Division of Geographic Information. This allowed my lab to obtain these data layers earlier than non-reviewers and to make sure it received a good evaluation of the quality of the riparian corridor, grassland, pasture, and other land use types critical in our analysis of CREP work. In fact, final corrections to the more detailed KLCD01 dataset were made and distributed to reviewers very recently (1 November 2005).

  Dr. Meier attended the annual ESRI GIS User's Conference in San Diego, California, 25-29 July 2005, for additional training, interaction, and acquisition of knowledge of new developments and techniques.

- **Activity 2**: **Analysis of historic and project water quality and biological data**

  We have been able to locate and download available USGS and Ky DOW (EPA STORET) water quality data. We also have in hand, full UGWW data, Ky DOW aquatic biological data, and some regional data from UK. There are additional USGS, MACA, and DOW water quality data that should be available, and those have been requested and promised. GIS data reflecting CREP enrollment contracts is not being released by NRCS or FSA at this time since it requires full review and correction by each county, not yet complete, but we are trying to obtain preliminary data. Data collected internally within project by other Tasks has also been requested and promised.

  Dr. Meier serves as the chair of the Science Advisory committee for Upper Green River Watershed Watch, the Kentucky Waterways Alliance Green River Basin delegate, and a

member of the Green River Basin Management Team. I am also currently a member of the Kentucky Watershed Modeling Information Portal Technical Advisory Group. These service efforts allow me to maintain contact with other agencies and groups working in the basin, integrate our work with complementary efforts by others, and have ready access to data and information coming out of these groups. With these data either in hand or on the way, we can move to the challenge of working the data into a common format, noting differences in sampling methods, regimes, and sites.

Dissemination of information in professional and regional settings is a deliverable of both major facets of this grant task. Presentations and posters presented at meetings are listed below. Other activities engaged in to support this project are also listed below as "Additional Support Activities."

Presentations and Posters

Meier, O.W., S. Grubbs, A. Meier, and J. Anmala. 2004. Analysis of landuse, climate, stream buffers, and water quality in the upper Green River Basin of Kentucky. Presentation at the Ecological Society of America meeting, Portland, Oregon, 1-7 August 2004. Attendance funded by another grant.

Meier, Ouida. 2005. The Upper Green River Biological Preserve and its Watershed Context. Presentation at the Organization of Biological Field Stations annual conference, Coweeta, Georgia, and Highlands, North Carolina, Sept. 2005.

Butler, J. Michael, Albert J. Meier, Ouida W. Meier, Benjamin Hughes. 2005. Bank characteristics and the occurrence of erosion slumps in the Green River, Central Kentucky. Poster presented at the Kentucky Academy of Sciences annual conference, Nov. 2005 (1st place student poster in ecology).

Grubbs, Scott A., Ouida W. Meier, and Albert J. Meier. 2005. Factors influencing the distribution of lotic fish assemblages in the Upper Green River - Kentucky CREP region. Presentation at the Kentucky Academy of Sciences annual conference, Nov. 2005.

Meier, Ouida, Albert Meier, and Scott Grubbs. 2005. The Upper Green River Biological Preserve A Partner in Restoring a World-Class River. Presentation at the Kentucky Academy of Sciences annual conference, Nov. 2005, .

Meier, Ouida, and Albert Meier. 2005. The Upper Green River Biological Preserve: A Partner in Restoring a World-Class River. Invited presentation at the 8th Annual Southeast Watershed Forum and 3rd Annual Kentucky State Watershed Roundtable, Bowling Green, Kentucky, Nov. 2005.

Additional Support Activities

CREP training offered at the Upper Green River Biological Preserve (UGRBP) by and for NRCS personnel on two occasions: 19 January 2005 and 28 July 2005.

Produced a display poster featuring the Green River and CREP for viewing by elected officials at the dedication of WKU's new Engineering and Biological Sciences building on 28 January 2005; since used many times at other events since.

Hosted meeting of CREP partners at WKU on 25 April 2005.

CREP Field Day participation: 17 August 2005 (provided map displays, podium, canoes; WKU's President Ransdell was an invited speaker at the event).

Participated in Green River mussel sampling by Jim Layzer, Tennessee Tech Univ., 25-26 August 2005.

Tours of the UGRBP, including Green River mussel rearing facility and CREP plantings, given to Southeast Watershed Forum attendees, 4 Nov. 2005.

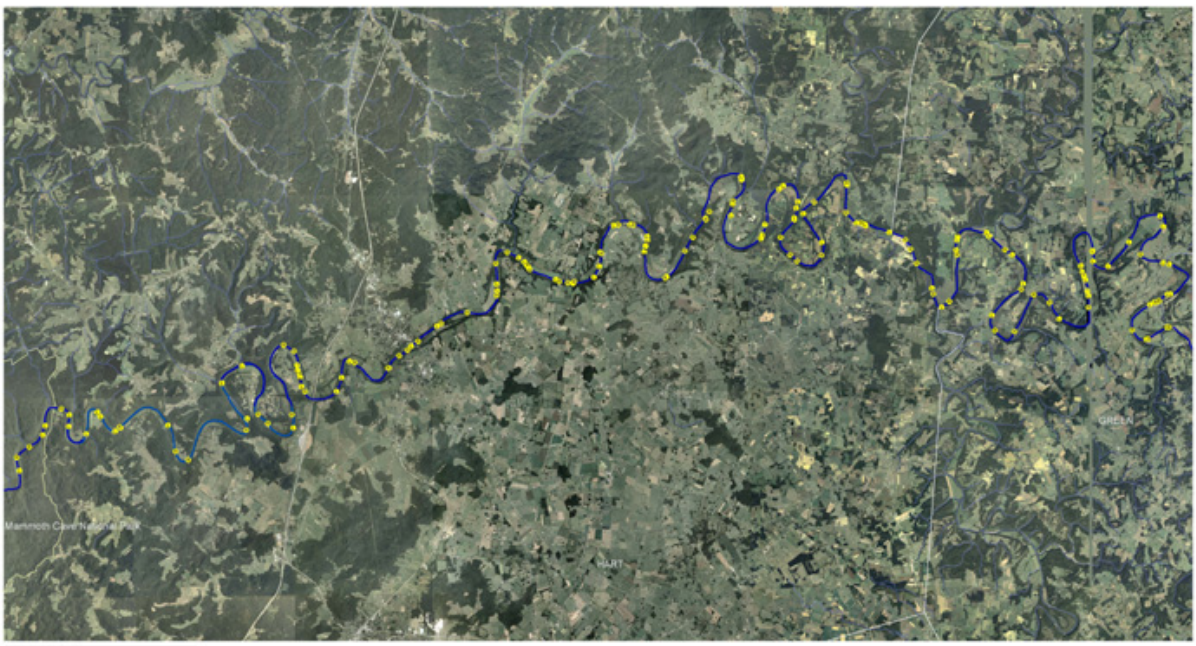
Produced maps to assist with discussion of proposed CREP expansion at a meeting of CREP partners, 22 Nov. 2005, Division of Conservation office, Frankfort, Ky.

Maps Produced: A Selection

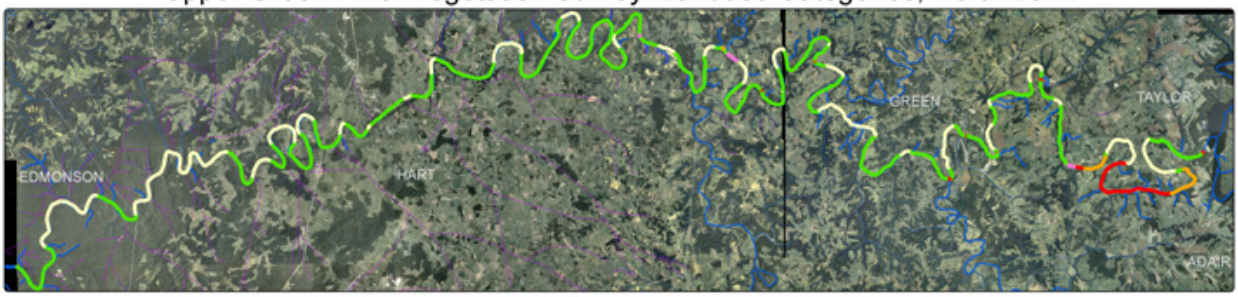
Numerous maps were produced in the course of beginning to gather and spatially analyze geographic information, field observations, and water quality data. Following is a selection of those maps.

Green River: Landuse and Stress Assessment, 1998

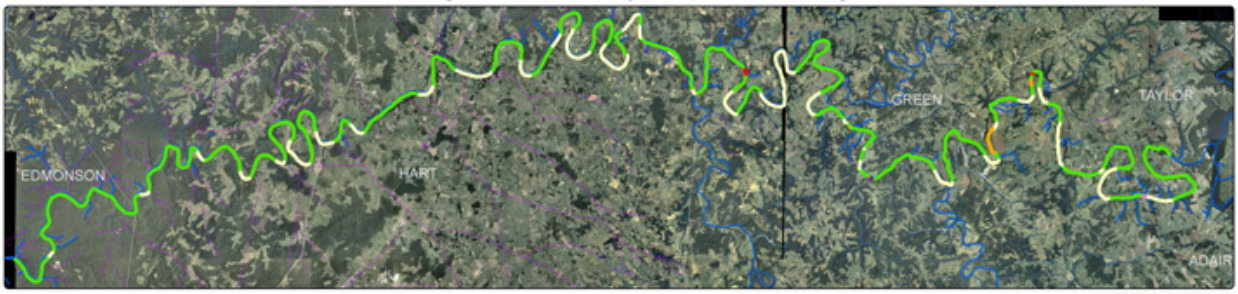
Riverbank Slump Survey, Upper Green River, 2003



Upper Green River Vegetation Survey: Landuse Categories, North Bank



Upper Green River Vegetation Survey: Landuse Categories, South Bank



Landuse at River Bank
- Cropland
- Developed, Open Space
- Herbaceous
- Pasture/Hay
- Riparian Forest with Red Cedar-Hemlock on Bluff
- Riparian Forest

County Boundaries
- Streams
- Karst Flow

Miles
0 5 10 15 20

Cartography: Benjamin Hughes and Kami MacDonald, 29 Aug 2005, in the lab of Dr. Ouida Meier, Western Kentucky University
Data Sources: Dr. Albert Meier and Jason Butler, vegetation survey, Jun-Aug 2005. Other layers: Ky DOW, NAIP04.

Note: These landuse categories were assigned specifically via river-level observation, Jun-Aug 2005.

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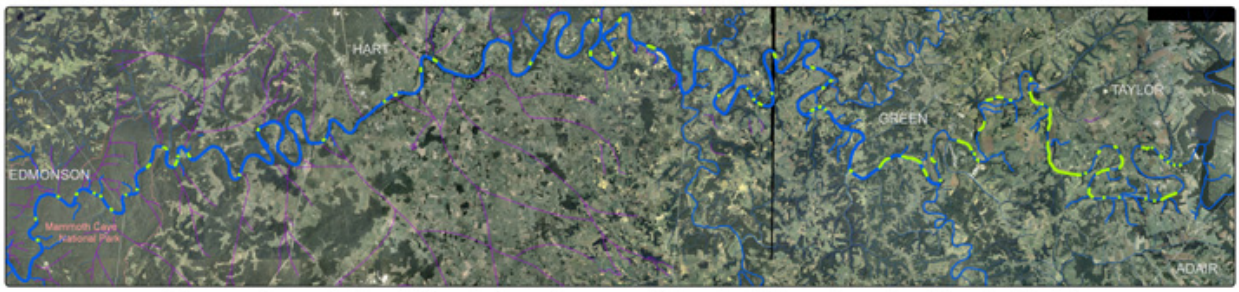
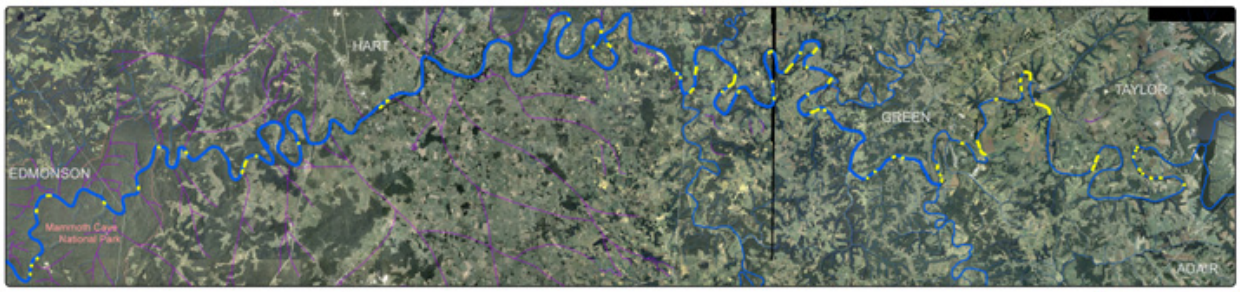
Upper Green River Vegetation Survey: Extent of Canebreaks, North Bank



Upper Green River Vegetation Survey: Extent of Canebreaks, South Bank



River Cane
- North Bank
- South Bank
- Karst Flow
- Streams
- County Boundaries

Cartography: Benjamin Hughes and Kami MacDonald, 29 Aug 2005, in the lab of Dr. Ouida Meier, Western Kentucky University
Data Sources: Dr. Albert Meier and Jason Butler, vegetation survey, Jun-Aug 2005. Other layers: Ky DOW, NAIP04.

Note: These areas of thin riparian corridor were assigned specifically via river-level observation, Jun-Aug 2005.

Miles
0 5 10

N

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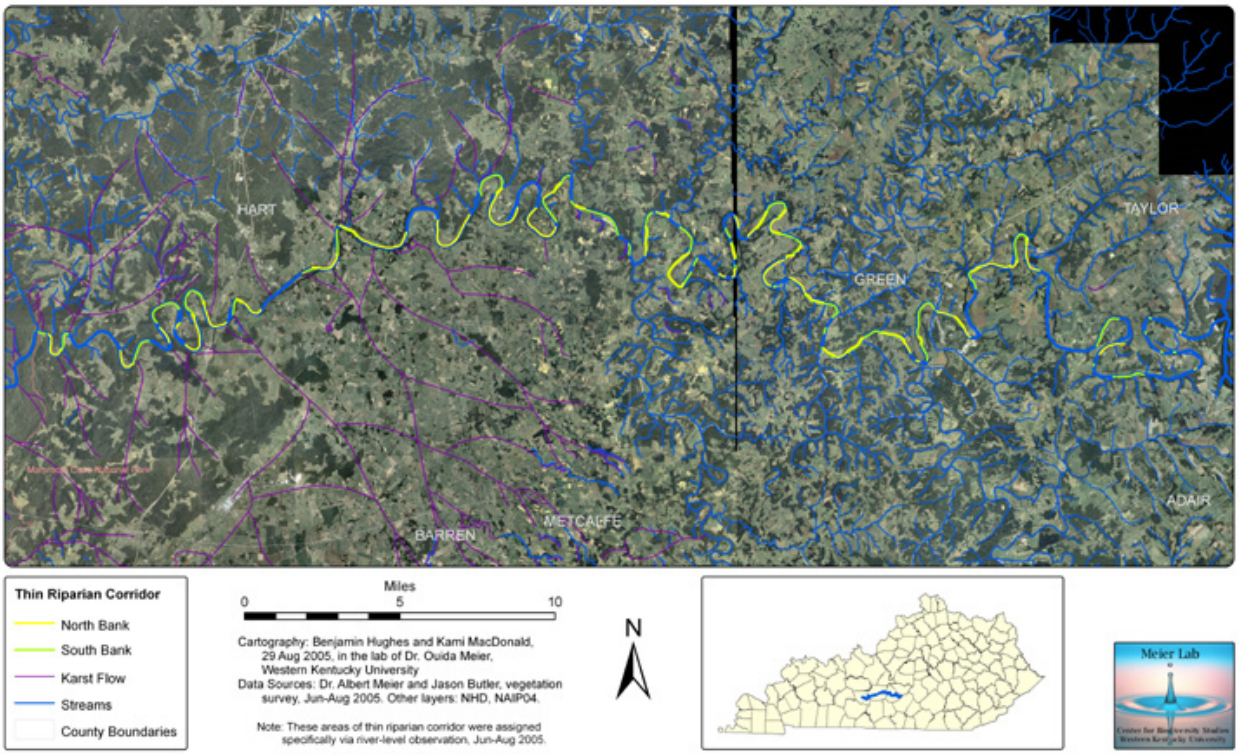
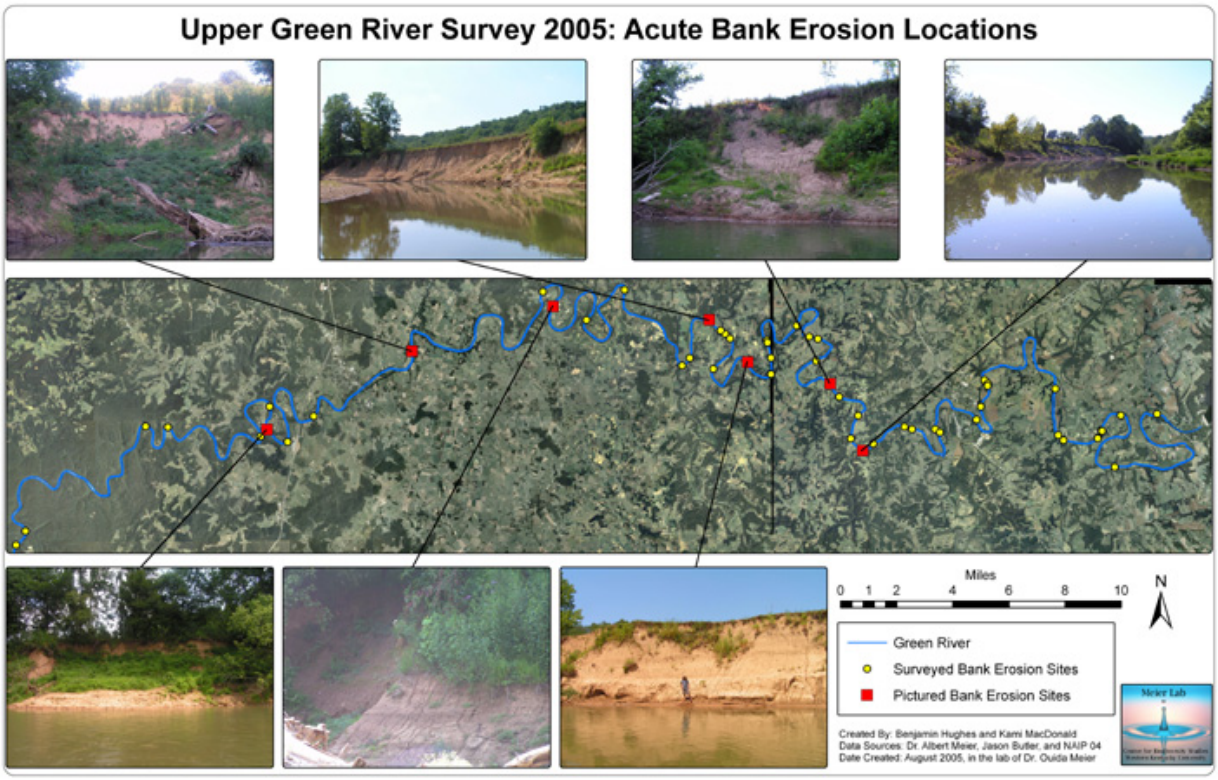
Upper Green River Vegetation Survey: Areas of Thin Riparian Corridor



Upper Green River Survey 2005: Acute Bank Erosion Locations



Bank Characteristics and the Occurrence of Erosion Slumps in the Green River, Central Kentucky

J. Michael Butler, Albert J. Meier, Ouida W. Meier, Benjamin Hughes, Western Kentucky University, Bowling Green, KY 42101

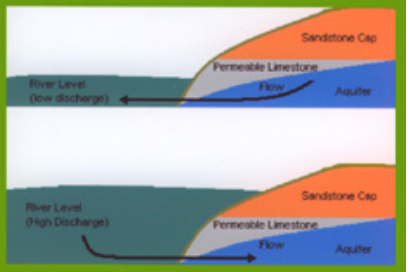
ABSTRACT

Increases in bank erosion may drastically alter a stream ecosystem. Eroding banks increase turbidity and sediment deposition on stream bottoms. We counted 54 major erosion slumps (>4 square m) over 175 km of the Green River in central Kentucky. Bank characteristics such as land use and presence of a riparian buffer were recorded with the erosion points. Nearly half of the portion of the river under study flows over a heavily karsted region. Fewer erosion slumps were associated with the karst landscape. Outside the karst drainage zone severe bank erosion is more frequent on banks lacking a riparian buffer. Our study suggest streams may be at higher risks of erosion when lacking a riparian buffer and not flowing through a karst landscape.

Zone	Number of Points	Expected Number	Significance
Karst	14	28	$X^2 = 14.5$ $p<0.001$
non-Karst	40	26	
Thin Buffer (non-karst)	27	10	$X^2 = 38.5$ $p<0.001$
Thick Buffer (non-karst)	13	30	

RESULTS

- The frequency of erosion points is higher in non-karst areas than in karst areas.
- River bank erosion rates are affected by the width of the adjacent forested riparian corridor.



INTRODUCTION

- Sediment damages a stream ecosystem through physical and chemical changes to the water and compositional alterations of the substrate.
- The Green River, a North American biodiversity hotspot, is home to several endangered and endemic species of mussel, fish, and crayfish.
- Through our study we looked at the frequency of erosion slumps on the river bank and in what areas these slumps were most likely to occur.

METHODS

- The use of land adjacent to the Green River as well as points of serious erosion on the banks of the river were mapped with GIS.
- GPS points were gathered from river level by canoe.
- Banks with less than 10 m of forest were classified as areas with a thin buffer
- An expected number of erosion points per classification of land use was calculated based on the percentage of the river bank length attributed to that land use.

DISCUSSION

- A riparian buffer along a stream will hold soil to the bank better than an open area such as a pasture, hay or crop field.
- We hypothesize a river flowing over a karst aquifer at a low stage is fed by the aquifer through springs and blue holes.
- We further hypothesize that in this karsted landscape, the river at high stage feeds water into the conduit-permeated aquifer, thereby altering the rate of discharge and the rate of bank erosion.

Special thanks to Adam DiIollo, Catarina Moreira, Chris Thomas and Mammoth Cave National Park

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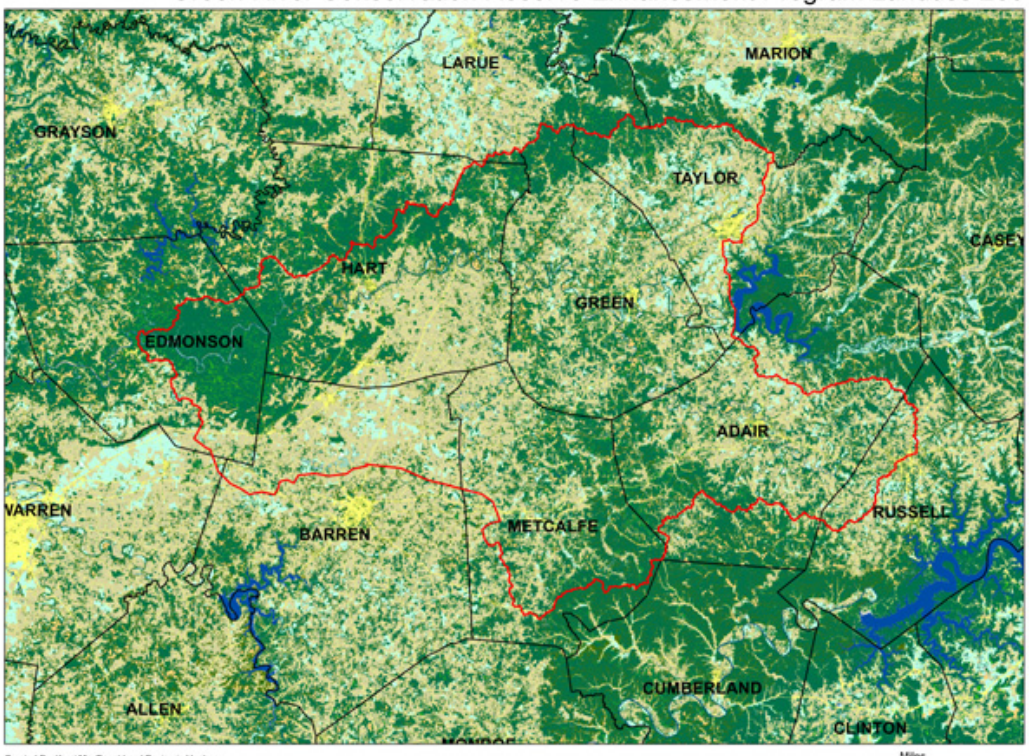
Center for Biodiversity Studies

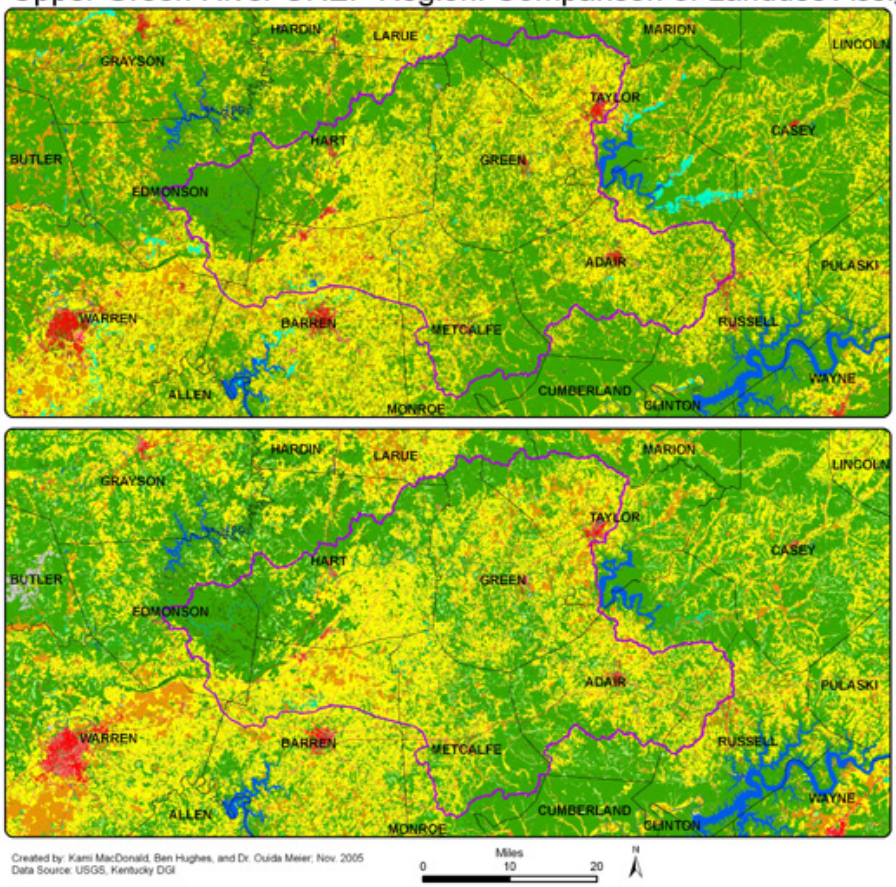
Green River Conservation Reserve Enhancement Program Landuse 2004



Created By: Kami MacDonald and Benjamin Hughes
Data Sources: Kentucky Division of Geographic Information, Dr. Ouida Meier, U.S. Geological Survey
Created in the lab of Dr. Ouida Meier

Meier Lab

Upper Green River CREP Region: Comparison of Landuse Assignments, 1990 - 2000



1990 Landuse Categories (NLCD92)

- Open Water
- Low Intensity Residential
- High Intensity Residential
- Commercial/Industrial/Transportation
- Bare Rock/Sand/Clay
- Quarries/Strip Mines/Gravel Pits
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Pasture/Hay
- Row Crops
- Small Grains
- Urban/Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetlands

2000 Landuse Categories (NLCD01)

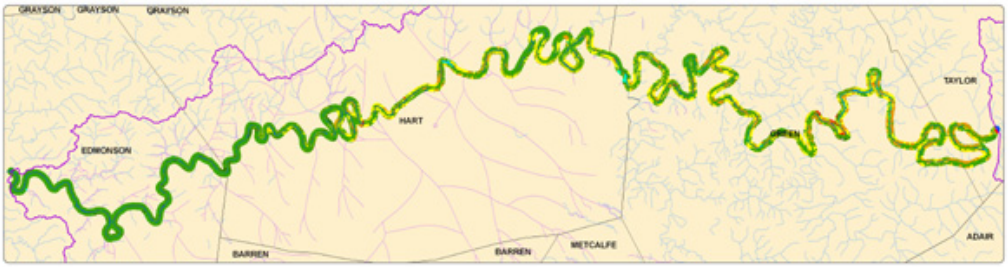
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Cropland
- Pasture/Hay
- Herbaceous
- Shrub
- Openland Mined
- Oak Forest
- Yellow Poplar Forest
- Mixed Deciduous Forest
- Pine Forest
- Red Cedar Forest
- Hemlock Forest
- Oak-Pine Mixed Forest
- Hemlock-Mixed Deciduous Forest
- Other Mixed Forest
- Deciduous Woodland
- Coniferous Woodland
- Mixed Woodland
- Water
- Oak/Deciduous Floodplain
- Riparian Forest
- Floodplain Forest
- Woodland Wetland
- Mixed Shrub Wetland
- Barren
- Mined Bare

Created by: Kami MacDonald, Ben Hughes, and Dr. Ouida Meier; Nov. 2005
Data Source: USGS, Kentucky DGI

Miles
0 10 20

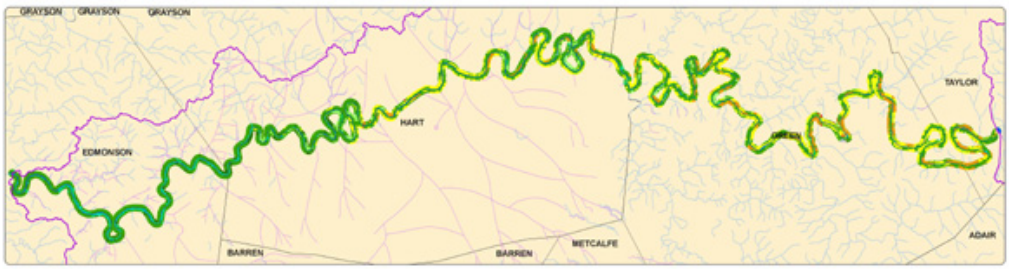
N

Upper Green River CREP Region: Comparison of Mainstem Riparian Landuse Assignments, 1990 - 2000



1990 Landuse, 1000ft Buffer (NLCD92)

- Open Water
- Developed, Low Intensity
- Developed, High Intensity
- Commercial/Industrial/Transportation
- Quarries/Strip Mines/Gravel Pits
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Pasture/Hay
- Row Crops
- Urban/Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetlands
- CREP Boundary
- Karst Flow
- Streams



2000 Landuse, 1000ft Buffer (NLCD01)

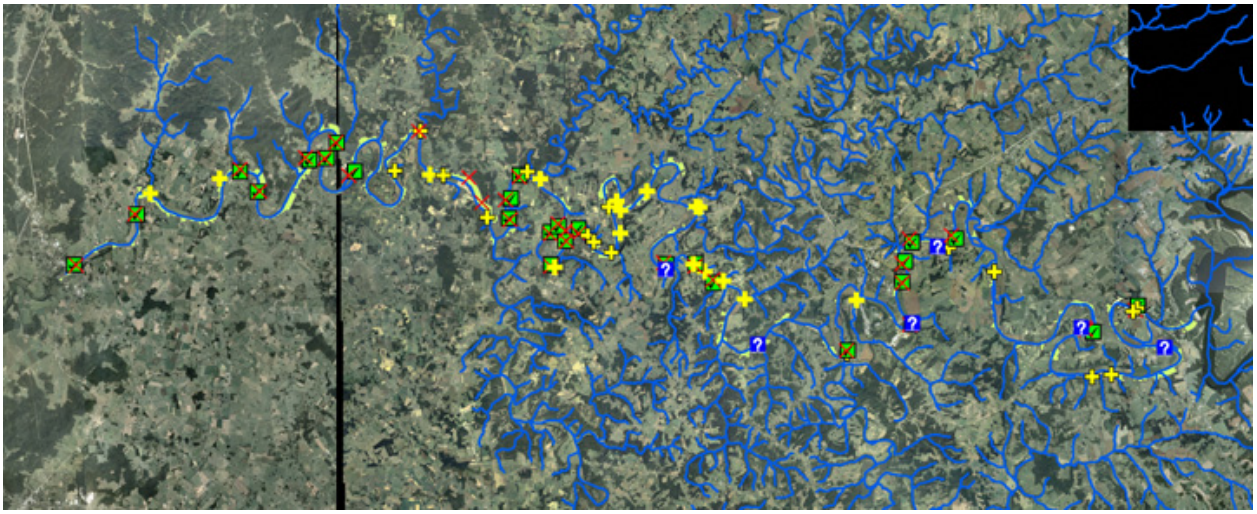
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Cropland
- Pasture/Hay
- Herbaceous
- Shrub
- Openland Mined
- Oak Forest
- Yellow Poplar Forest
- Mixed Deciduous Forest
- Pine Forest
- Red Cedar Forest
- Hemlock Forest
- Oak-Pine Mixed Forest
- Hemlock-Mixed Deciduous Forest
- Other Mixed Forest
- Deciduous Woodland
- Coniferous Woodland
- Mixed Woodland
- Water
- Oak/Deciduous Floodplain
- Riparian Forest
- Floodplain Forest
- Woodland Wetland
- Mixed Shrub Wetland
- Barren
- Mined Bare
- CREP Boundary
- Streams
- Karst Flow

Miles
0 125 250 375 500

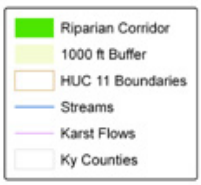
N

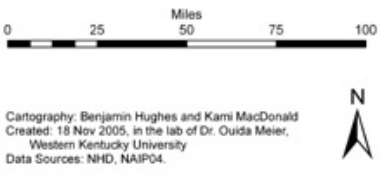
Created by Kami MacDonald, Benjamin Hughes, and Dr. Ouida Meier, Nov 2005
Data Source: USGS, Kentucky DGI

Upper Green River Mainstem:
Adjustments to National Hydrologic Dataset Representations of Flow Patterns

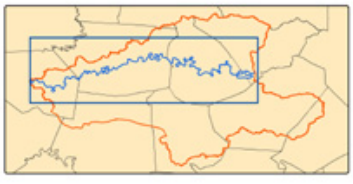


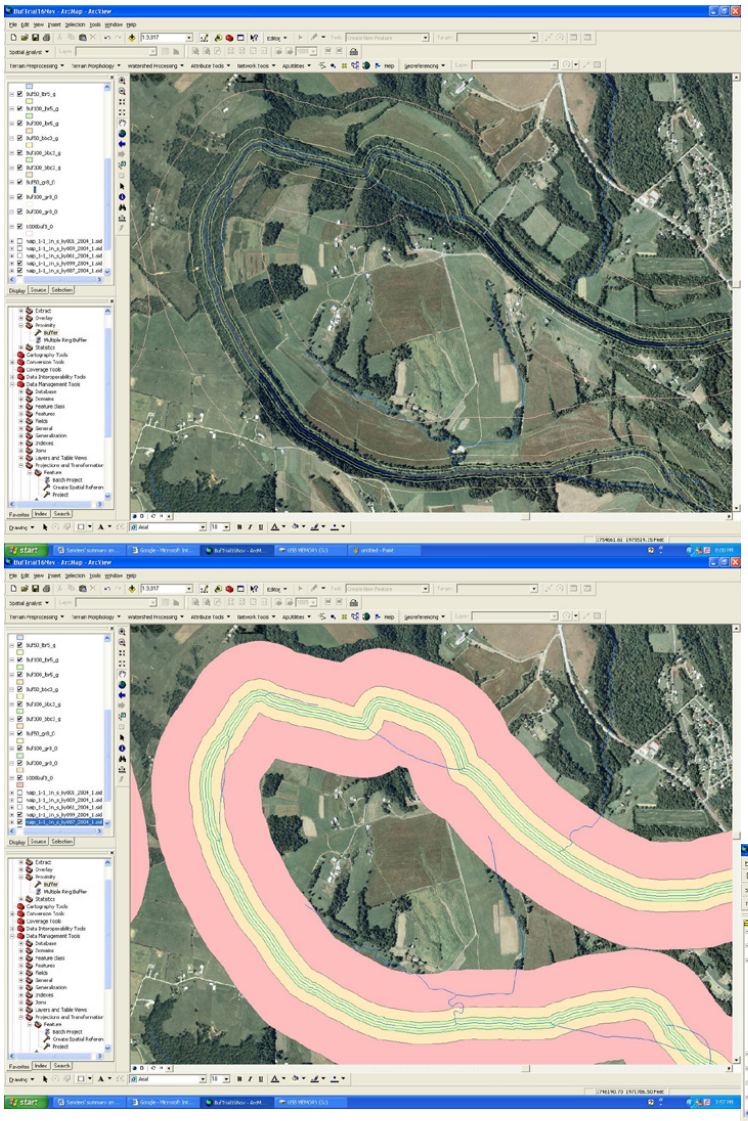
Upper Green River Mainstem:
Potential and Current Forested Riparian Corridor



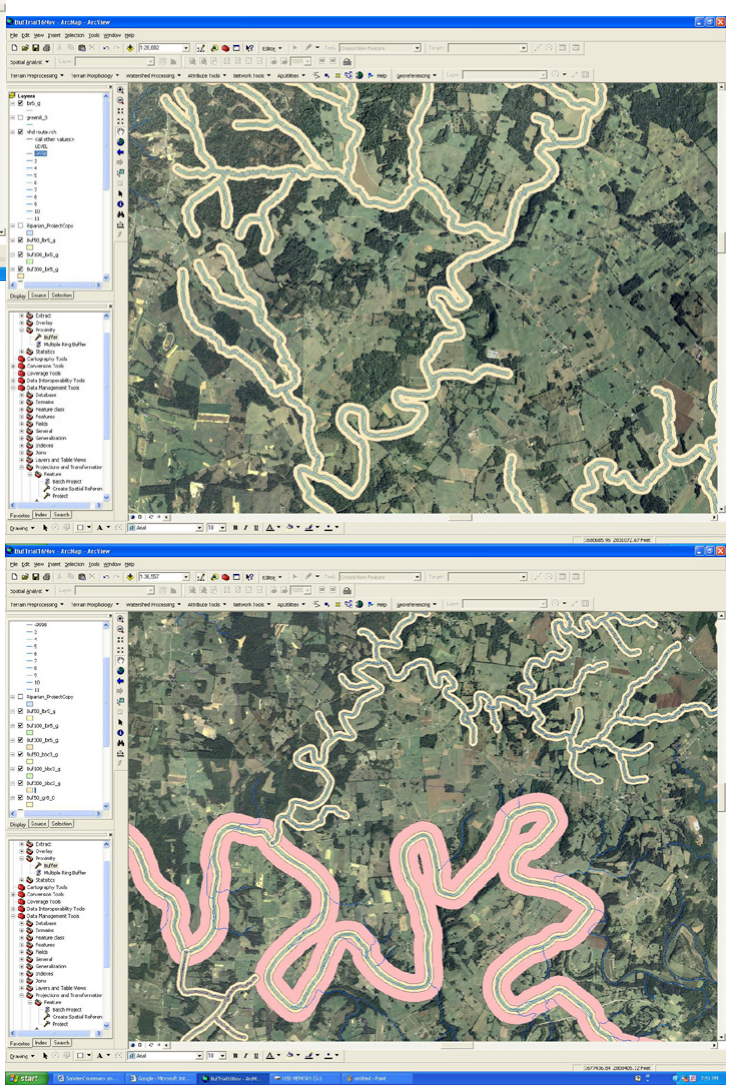


Cartography: Benjamin Hughes and Kami MacDonald
Created: 18 Nov 2005, in the lab of Dr. Ouida Meier,
Western Kentucky University
Data Sources: NHD, NAIP04.

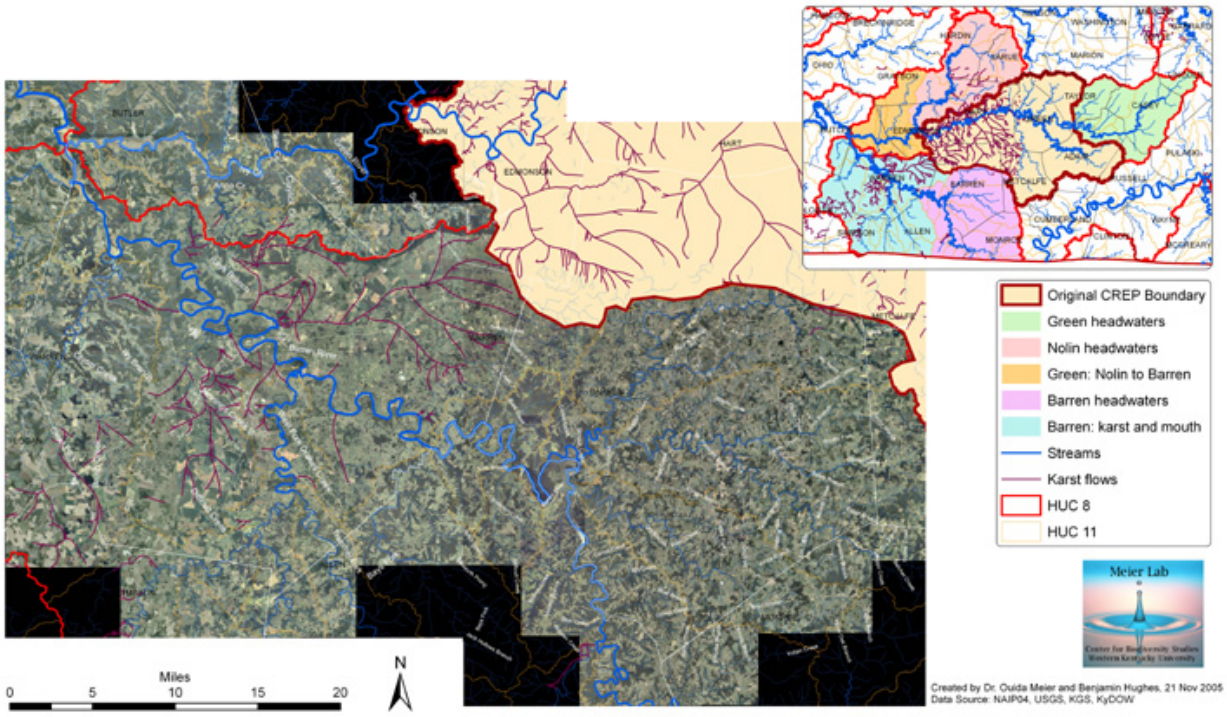




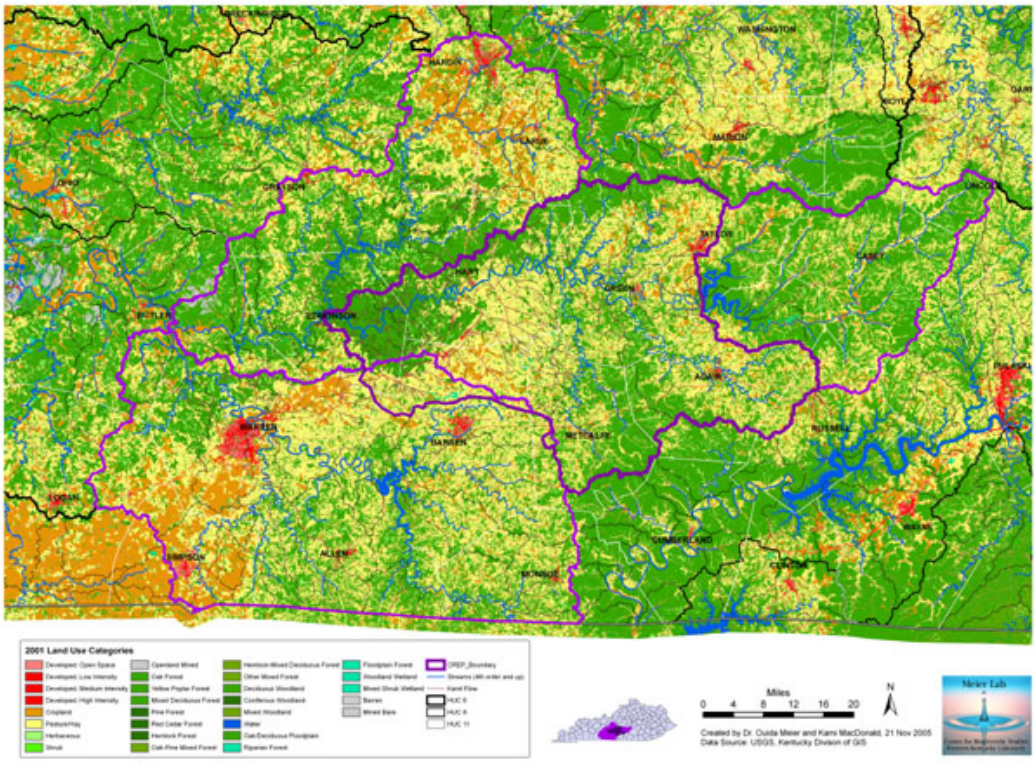
Illustrations of 50-foot, 100-foot, 300-foot and 1000-foot buffer analyses along the mainstem of the Green River and some tributaries. Both landuse and riparian corridor are being selected from the resulting polygons. The re-routing of some of the NHD dataset flows along the mainstem are also illustrated. A number of 4th-order tributary streams are also being declared eligible for 1000-foot buffer protection; additional GIS work will be needed to represent this and other expansion potentials.



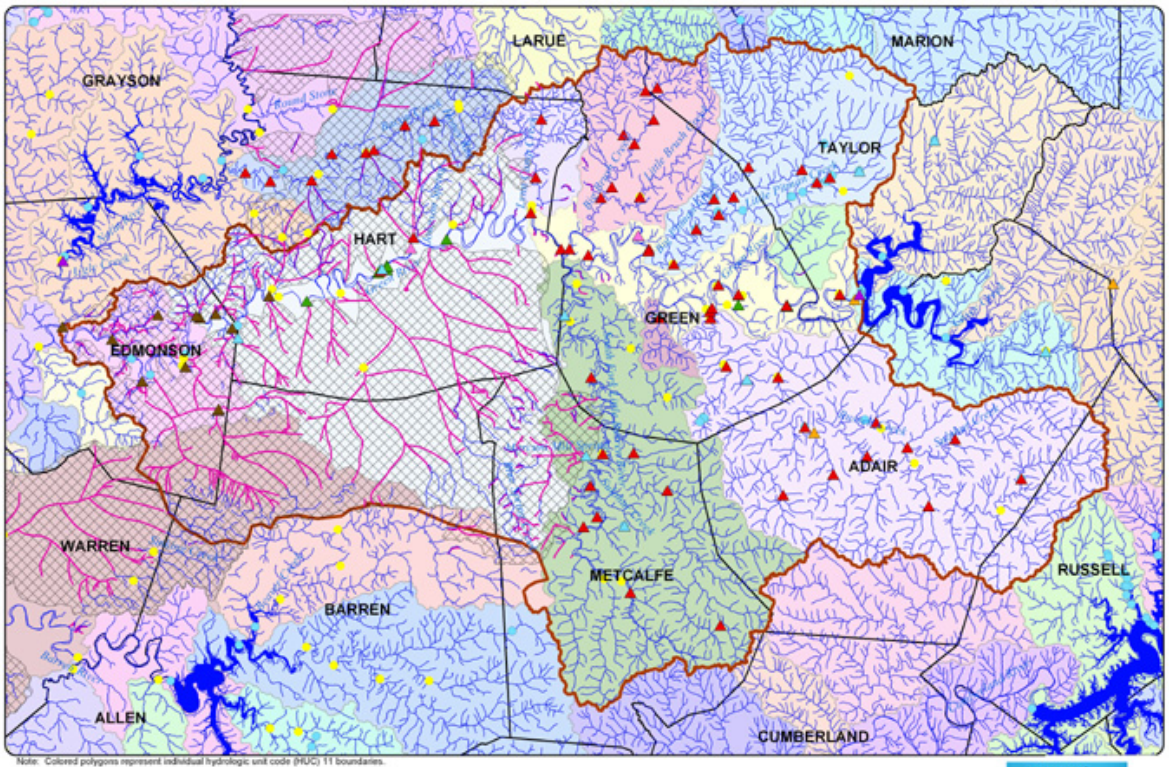
Green River Conservation Reserve Enhancement Program: Potential Expansion



Green River Conservation Reserve Enhancement Program: Potential Expansion



Green River CREP Area Monitoring Sites 2002



Note: Colored polygons represent individual hydrologic unit code (HUC) 11 boundaries.

N

Miles
0 5 10

WKU
DOW
USGS
ACOE
MCNPS
TNC
EPA
PreCREP WKU
PreCREP DOW
PreCREP Other
UGWW
Historic DOW
Stream
Karst Flow
Karst Basin
CREP Boundary
County Boundary

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Center for Biodiversity Studies
Western Kentucky University

Created by: Jenna Medlin and Dr. Ouida Meier, 2002; updated by Kami MacDonald, 2005

Task 2 Progress Report: Hydrology, sediment and water quality monitoring activities

Task 2 Manager: Stephen Kenworthy, Ph.D., Department of Geography and Geology, Western Kentucky University

Four activities

- **Activity 1**: **Analysis of historical patterns of channel migration and field surveys of in-channel and floodplain sediment storage**

  Sediment Sampling: As of Sept. 30 2005, samples of streambed sediment have been collected from a 14 sites on the Green River within the CREP area, as well as from several tributary sites. Data are available on request.

  Bank erosion: Five sets of digital aerial photographs of the reach between Green River Lake and Russell Creek, spanning the time period between 1953 and 1997 have been obtained from the USDA. Analysis of this imagery to assess historical patterns of channel migration and changes in island morphology is ongoing. Sites for detailed bank erosion monitoring have been identified, and field surveys are planned for FY 2006.

  Alluvial Deposits: Preliminary analysis of alluvial deposits mapped on KY geologic quadrangles has been completed. Field sampling of deposits and estimation of storage volumes is planned for FY 2006.

- **Activity 2**: **Streamflow gaging and suspended sediment collection @ 3 mainstem Green River sites** (Mammoth Cave Ferry, Munfordville, Greensburg)

  Greensburg monitoring site: USGS stream gaging activities are ongoing. Data are available from the USGS KY Water Science Center in Louisville. Suspended sediment sample collection has been limited owing to dry weather conditions since Spring 2005. Continuous turbidity monitoring equipment has been installed to enhance estimates of sediment fluxes during the high runoff season.

  Munfordville monitoring site: USGS stream gaging activities are ongoing. Data are available from the USGS KY Water Science Center in Louisville. Suspended sediment sample collection has been limited owing to dry weather conditions since Spring 2005. Continuous turbidity monitoring equipment has been installed to enhance estimates of sediment fluxes during the high runoff season.

  Mammoth Cave Ferry monitoring site : USGS stream gaging and continuous water quality monitoring activities are ongoing. Data are available from the USGS KY Water Science Center in Louisville.

- **Activity 3**: **Flow gaging and suspended sediment collection @ Green River surface tributary site**

  Pitman Creek monitoring site: A streamflow gaging and suspended sediment monitoring station has been established on Pitman Creek, northwest of Greensburg in Green County. River stage and turbidity are monitored continuously, and suspended sediment sampling

and gaging will continue through FY 2006. Sediment data collected to date are limited owing to dry weather conditions since Spring 2005. Data are available on request.

- **Activity 4 Subsurface flux and water quality monitoring**

  Logsdon River monitoring site: A continuous flow and water quality monitoring site has been established in Logsdon River, a cave stream within the Turnhole karst basin in Barren and Edmonson Counties. Flow stage and flow velocity are monitored via acoustic Doppler velocimetry. Turbidity, temperature, specific conductivity and pH data are recorded by a multi-sensor water quality sonde. Suspended sediment concentration and grain size are monitored via Laser In-Situ Scattering and Tranmissometry (LISST) technology. Data collection has been ongoing since July 2005, however sediment flux estimates to date are limited owing to technical problems and dry weather conditions since Spring 2005. Data are available on request.

Task 3 Progress Report: Direct Terrestrial Monitoring Activities

Task 3 Manager: Albert Meier, Ph.D., Department of Biology, Western Kentucky University

Two activities

- **Activity 1**: **Analysis and mapping of stream bank vegetation of the Green River**

  Streamside vegetation along the main stem of the Green River within the CREP area has been mapped. Locations of severe stream bank erosion have been mapped (Fig. 1), and distribution of switchcane (*Arundinaria gigantea*), a species that is particularly good at controlling erosion, has been mapped (Fig. 2). A lower proportion of severe erosion locations occurs within the karst drainage area down stream from the Little Barren River than upstream. Within the area upstream of the Little Barren proportionately more severe erosion sites are located where stream side buffers are thin. No significant difference was found in the karst drainage area below the Little Barren River.

- **Activity 2**: **Bio-acoustic monitoring of riparian corridor wildlife**

  Digital catalogs of regional amphibians and birds have been developed. The frog catalog is almost complete. Monitoring sites have been chosen, but delivery of the field recording systems has been delayed by the manufacturer.

- **Activity 3**: **Analysis of Restoration of Grasslands**

  A detailed vegetation analysis comparing CREP fields with native barrens and with pastures has been completed for the summer and fall growing seasons. Vegetation in the CREP fields differs substantially from both barrens and the pastures. We still need to perform spring vegetation sampling. Small mammal and bird sampling within the grasslands will begin this winter and spring. Sampling sites for birds will overlap with the vegetation monitoring sites.

Task 4 Progress Report: Project Enhancements and Pilot Studies

Task 4 Manager: Scott Grubbs, Ph.D., Department of Biology and Center for Biodiversity Studies, Western Kentucky University

Four activities

- **Activity 1: Longitudinal distribution of macroinvertebrates along the Upper Green River**

  Sampling reaches along the mainstem of the Green River between the Green River Lake and Mammoth Cave National Park (MCNP) were established only on 10 of those 14 originally anticipated due to (1) extreme low water conditions made it time-consuming to drive a boat up to the Cave Island riffle in MCNP and (2) three riffles were too small for the *aprior*-planned sampling design. Sampling for macroinvertebrates was conducted in mid- to late-August, yet only five reaches were completely sampled prior to the strong storm remnants from Hurricane Katrina. Water levels rose significantly and I felt that the post-storm sampling should not have been completed once water rivers levels returned to pre-storm conditions. This study will be repeated in 2006.

- **Activity 2: Triazine levels in the Upper Green River Basin**

  In total, 60 sampling reaches have been established within the Upper Green River Basin. Sampling for triazines was conducted monthly from May-July 2005. Triazine levels have been quantified by the WATERS laboratory at Western Kentucky University for all samples and data analysis is forthcoming. Data is available upon request.

- **Activity 3: Distribution of mussels in the Upper Green River Basin**

  Little information exists regarding quantitative distribution of riverine mussels in any of the principle subbasins (e.g., Russell Creek). Quantitative (numbers of individuals per unit area) or semiquantitative sampling (numbers of individuals per unit effort) for mussels will occur during baseline flow conditions during summer 2005. A subcontract will be established with Mammoth Cave National Park because of the need for technical assistance. This work will continue through summer 2006 on a new set of subbasin sites. The number of sites to be monitored both in summer 2005 and summer 2006 have not been established.

- **Activity 4: Distribution of riverine fishes in the Upper Green River Basin**

  Eight new stream reaches were sampled as two separate sampling events between July and August 2005. Two reaches were along the mainstem Upper Green River and six reaches were located with three of the major subbasins (i.e., Big Brush Creek, Big Pitman Creek, Russell Creek). Overall, sampling for stream fishes have now been completed for each of the 60 reaches in the Upper Green River Basin. Data is available upon request.

- **Additional Activities**

  1. Although not conveniently placed within only one of the four activities listed above, several chemical and physical parameters were quantified between May and August 2005. These parameters provided a critical analytical backbone for the analyzing the

distribution of fish, mussels, crayfish, and other macroinvertebrates within the Upper Green River Basin. Mean stream velocity, depth, and discharge were quantified from each of the 60 stream reaches during the low-flow conditions in July and August. The remaining parameters were quantified during May, June and July. Parameters measured with a HydroLab multiprobe sonde included (a) temperature, (b) pH, (c) conductivity, (d) salinity, (e) total dissolved solids, and (f) turbidity. Parameters quantified by the WATERS laboratory at Western Kentucky University were (a) nitrate-nitrogen, (b) ammonia-nitrogen, (c) total phosphorous, (d) orthophosphate-phosphorous, (e) total suspended solids, (f) chloride, and (g) sulfate. Data is available upon request.

2. The distribution of crayfish in the Upper Green River Basin, now considered herewithin as Activity 5, was added during summer 2005. The Upper Green River Basin, in addition to the Barren River Basin, is the main locality of the bottlebrush crayfish (*Barbicambarus cornutus*). Sampling has yet to commence, but the sampling design and reaches to be sampled have been established. Sampling is expected to begin by spring 2006.

Task 5 Progress Report: Seminars and workshops

Task 5 manager: Albert Meier, Ph.D., Department of Biology, Western Kentucky University

One activity

- **Activity 1**: **Seminars and Workshops**

  Dr. Rafael Marquez has presented a seminar and workshop on bioacoustic monitoring. A MS PowerPoint has been attached to my web page at http://bioweb.wku.edu/faculty/Ameier/. Additional seminars and workshops are being planned for the spring and summer.

IV. Recommendation

Partner Listing:

USDA Farm Service Agency
USDA Natural Resources Conservation Service
The Office of the Governor
The Kentucky General Assembly
The Kentucky State Nature Preserves Commission
The Kentucky Soil and Water Conservation Commission
Kentucky Division of Conservation
Kentucky Division of Forestry
Kentucky Division of Water
The Kentucky Department of Fish and Wildlife Resources
The Nature Conservancy
Mammoth Cave National Park
Kentucky's Soil and Water Conservation Districts

Thanks to the partner agencies and organizations for their commitment to this project and to the landowners and natural resources of this unique area.

The Kentucky Green River CREP is continuing with moderate success, and with the hopeful acceptance of the proposed changes currently in the submittal process, this program should have a very bright future. With 9,542 acres enrolled, over $21 million to be paid to local landowners on these existing contracts, and 134.5 miles of stream in conservation use, a difference has already been made in the local area. In addition to the programmatic changes that are being requested, additional area is being proposed for the Green River CREP Region downstream of our current boundaries. With our experiences and working knowledge of this program, more effective training and public relations will

be utilized; this should energize the local population and staff for continued and increased success of this program.

Cattle lounging in the Green River. Photo courtesy of Joe Meiman, Mammoth Cave National Park

Green River bank with slump…areas such as these will be targeted by future PR efforts. Photo courtesy of J. Meiman